



Designation: D5313/D5313M – 21

Standard Test Method for Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions¹

This standard is issued under the fixed designation D5313/D5313M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This test method covers procedures for evaluating the durability of rock for erosion control when exposed to wetting and drying conditions on slabs of rock using both qualitative and quantitative methods. This durability test exposes the rock samples to a cycle of wetting and drying such as those experienced due to fluctuating water levels and weather conditions, with tests done at room temperature as the baseline. The rock slabs, prepared per procedures in Practice D5121, are intended to be representative of the proposed source of erosion control rock and its weaknesses.

1.2 The test is appropriate for breakwater stone, armor stone, riprap, and gabion sized rock materials.

1.3 The limitations of the test are twofold.

1.3.1 First, the size of the cut rock slab specimens may eliminate some of the internal defects present in the rock structure. The test specimens may not be representative of the quality of the larger rock samples used in construction. Careful examination of the rock source and proper sampling is essential in minimizing this limitation.

1.3.2 Secondly, the test requires the rock slabs to be exposed to 80 cycles of wetting and drying. The test is time-intensive and would require a minimum of three months and up to six months to complete the sample preparation, testing, and analysis portions of the procedure.

1.4 The use of reclaimed concrete and other such materials as rip rap is beyond the scope of this test method.

1.5 *Units*—The values stated in either SI units or inch-pound units [presented in brackets] are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used inde-

pendently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.5.1 The gravitational system of inch-pound units is used when dealing with inch-pound units. In this system, the pound (lbf) represents a unit of force (weight), while the unit for mass is slugs. The slug unit is not given unless dynamic ($F=ma$) calculations are involved.

1.5.2 It is common practice in the engineering/construction profession to concurrently use pounds to represent both a unit of mass (lbm) and of force (lbf). This practice implicitly combines two separate systems of units; the absolute and the gravitational systems. It is scientifically undesirable to combine the use of two separate sets of inch-pound units within a single standard. As stated, this standard includes the gravitational system of inch-pound units and does not use/present the slug unit for mass. However, the use of balances or scales recording pounds of mass (lbm) or recording density in lbm/ft³ shall not be regarded as nonconformance with this standard.

1.5.3 Calculations are done using only one set of units; either SI or gravitational inch-pound. Other units are permissible, provided appropriate conversion factors are used to maintain consistency of units throughout the calculations, and similar significant digits or resolution, or both are maintained.

1.6 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026, unless superseded by this standard.

1.6.1 For purposes of comparing measured or calculated value(s) with specified limits, the measured or calculated value(s) shall be rounded to the nearest decimal or significant digits in the specified limits.

1.6.2 The procedures used to specify how data are collected/recorded or calculated in this standard are regarded as the industry standard. In addition, they are representative of the significant digits that generally should be retained. The procedures used do not consider material variation, the purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to be

¹ This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.17 on Rock for Erosion Control.

Current edition approved Feb. 1, 2021. Published February 2021. Originally approved in 1992. Last previous edition approved in 2013 as D5313/D5313M – 12(2013). DOI: 10.1520/D5313_D5313M-21.

commensurate with these considerations. It is beyond the scope of this standard to consider significant digits used in analytical methods for engineering design.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D2216 Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing

D4992 Practice for Evaluation of Rock to be Used for Erosion Control

D5121 Practice for Preparation of Rock Slabs for Durability Testing

D5240/D5240M Test Method for Evaluation of the Durability of Rock for Erosion Control Using Sodium Sulfate or Magnesium Sulfate

D5312/D5312M Test Method for Evaluation of Durability of Rock for Erosion Control Under Freezing and Thawing Conditions

D6026 Practice for Using Significant Digits in Geotechnical Data

3. Terminology

3.1 Definitions:

3.1.1 See Terminology **D653** for general definitions.

3.1.2 *armor stone, n*—stone generally 900 to 2,700 kg [1 to 3 tons] resulting from blasting, cutting, or by other methods placed along shorelines or in jetties to protect the shoreline from erosion due to the action of large waves. **D5240/D5240M, D5312/D5312M**

3.1.3 *breakwater stone, n*—stone generally 2,700 to 18,000 kg [3 to 20 tons] resulting from blasting, cutting, or by other methods placed along shorelines or in jetties to protect the shoreline from erosion due to the action of large waves. **D5240/D5240M, D5312/D5312M**

3.1.4 *gabion-fill stone, n*—stone generally less than 22 kg [50 lb] and placed in baskets of wire or other suitable material. These baskets are then tied together to form an integral structure designed to resist erosion along stream banks and around bridge piers. **D5240/D5240M, D5312/D5312M**

3.1.5 *riprap stone, n*—stone generally less than 1,800 kg [2 tons] specially selected and graded, when properly placed prevents erosion through minor wave action or strong currents, and thereby preserves the shape of a surface, slope, or underlying structure. **D5240/D5240M, D5312/D5312M**

3.1.6 *rock saw, n*—a saw capable of cutting rock.

3.1.6.1 *Discussion*—The term “rock saw” shall include the blade which saws the rock, any components that control or power the sawing process or both, and the framework on which the blade and any other associated components are mounted. **D5240/D5240M, D5312/D5312M**

3.1.7 *slab, n*—a section of rock having two smooth, approximately parallel faces, produced by two saw cuts, which will subsequently undergo durability tests. The words “slab” and “specimen” are interchangeable throughout the test method.

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3.2 Definitions of Terms Specific to This Standard:

3.2.1 *room temperature, n*—colloquially, the range of air temperatures that most people prefer for indoor settings, which feel comfortable when wearing typical indoor clothing.

3.2.1.1 *Discussion*—Human comfort can extend beyond this range depending on humidity, air circulation, and other factors. In specific fields, like science and engineering, and within a specific context, room temperature can mean different agreed-on ranges. In contrast, ambient temperature is the air’s actual temperature (or other medium and surroundings) in any particular place, as measured by a thermometer. It may be very different from the usual room temperature, for example, an unheated room in winter.

4. Summary of Test Method

4.1 Erosion control rock samples are selected, and the pieces within each sample type are trimmed into saw-cut slab specimens. Each slab is structurally examined macroscopically and under 20× magnification.

4.2 The specimens are exposed to 80 wetting-drying cycles. Each cycle consists of full immersion in potable water for a minimum of 12 h, then drying under infrared heat lamps or in an oven for a minimum of 6 h. A visual examination of the slabs is performed throughout and at the end of testing.

4.3 At the completion of the test, the percent loss by mass for each specimen slab and sample type is determined. The type of deterioration and changes to previously noted planes of weakness are recorded.

5. Significance and Use

5.1 Rock for erosion control consists of individual pieces of natural stone. The ability of these individual pieces of stone to resist deterioration due to weathering action affects the stability

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.